

Stephen Bowlsby

1. **The mysterious "Herkenham Effect"**
Contrary to all expectation, brain-maps of the many different neurotransmitter types do not match the maps of their corresponding receptors. Does this demand a radical re-interpretation of brain function?
2. **The riddle of the receptor reversals**
In the visual cortex the many different neurotransmitter receptor types are segregated into separate layers of neurons. During the period of maturation when visual experience molds our perception, these receptors change their locations, re-appearing on cells in completely different layers. What is the meaning of this fundamental overhaul?
3. **The NMDA receptor**
The unique and complex attributes of this ubiquitous brain neurotransmitter receptor may be at the heart of our memories and our capacities.
4. **LTP: rival to the sea slug**
When popular-science magazines feature mechanisms of memory they focus on research with Aplysia, the now-famous invertebrate. But even more exciting is the work on mammals showing a completely different, and much more relevant, mechanism of learning, "LTP" (longterm potentiation). It seems LTP has been eclipsed by Eric Kandel's crusade for a Nobel Prize, and this story cries out to be told.
4. **Pathfinding in the brain: how does the brain wire itself up?**
During development the axons (output channels) of neurons must navigate across immense distances and find their rightful connections. How this is accomplished is slowly being brought to light.
5. **Penfield was wrong: modern theories of memory**
New evidence, and re-interpretation of the old, indicates that the conventional notion of memories as whole, accurate, stored "images", is not true -- rather, memories are re-constructions at the moment of "recall", subject to many potential distortions.
6. **Neural network modeling**
Computer simulations of the kind of massively parallel, distributed processing carried out by the brain are revolutionizing our understanding of perception and thought, and of how the brain itself must work.

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7. *Neural Darwinism*

Nobel laureate Gerald Edelman has developed a controversial theory of brain function in which learning results from "natural selection" amongst neurons. How different is Neural Darwinism from the classic model put forth by Donald Hebb fifty years before?

8. *Intelligence by elimination*

The capacities of our brains are established more by eliminating connections than by making new ones. Failure to eliminate the majority of synapses made by our neurons in childhood spells permanent retardation.

9. *Why these myriad messengers?*

Why does the brain employ so many different types of neurotransmitters? The answer is not obvious, and speculation reveals several fascinating possibilities.

10. *Neurons and instinct*

The study of the cellular basis of natural behaviors in simple animals is a booming business in brain science.

11. *Brain scanners*

What can -- and can't -- these machines tell us?

12. *Ion channels: the foundations of the mind*

Ion channels are the elements of neurons that generate and modulate literally all of the activity of our brains. A review of their function and diversity provides a profound insight into what makes us tick.

13. *The cerebral cortex:*

The cortex is a highly modular and periodic structure. What does that tell us about its function?